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WHY SPACE?*

by

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No one will question that the world has entered a new age, -- the Age of Space. Perhaps this fact was not fully recognized when the first Soviet Sputnik was launched in October 1957, in spite of the world-wide shock produced by that startling event. But, surely, no doubt remains after the orbital flights of Gagarin, Titov, and John Glenn. The wide-open conduct of Colonel Glenn's flight has served to impress further upon the entire world the reality of the Space Age.

Every one of us is affected, directly or indirectly, by the effort to investigate, explore, and make use of outer space. This tremendous

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activity affects our economy, scienee, technology, education, and welfare. It has become an important element in the Cold War, the outcome of which is certainly vital to us, our children, and their children.

The space program is important to us. It needs, and should have, the understanding support of the citizens of this great country, not only through their dollars, but also through a vigorous personal interest in what we are doing in space, and how well we are doing it.

The roots of the space program reach far back into the past, much farther perhaps than one might think offhand. One might claim that the seed was sown in the Thirteenth Century when the first rocket was born in the form of the fire arrow. Or perhaps one might prefer to trace the roots back to the fanciful writings of such authors as Edward Everett Hale with his "Brick Moon" or Jules Verne with his "Trip to the Moon," in 1865. It seems more reasonable,

however, to ascribe the early beginnings to those technical men who first consciously devoted their attention to developing the means whereby space flight could actually be accomplished. There was Tsiolkovsky, who at the very beginning of the Twentieth Century laid some of the theoretical ground work, and in his writings pointed to the day when men would leave the earth for a flight into space. There was our own Robert Goddard who, early in this century, not only developed the theory of the sounding rocket, but also plunged into a vigorous and fruitful experimental program to bring the rocket into being. In the 1920's the German pioneers began the activities that ultimately produced the tremendous V-2 Rocket of World War II. Out of these pioneering efforts came the modern giant missile on the one hand, and the sounding rocket and space vehicle on the other.

In 1945 the United States began to use rockets to explore and investigate the outer edges of the

earth's atmosphere. This activity developed rapidly into a vigorous and fruitful scientific effort, paralleling a similar one in the Soviet Union. The rocket sounding of the upper atmosphere laid the ground work for the scientific satellite program of the International Geophysical Year. But, although the scientists and engineers had long been at work on the development and use of rockets for the exploration of the earth's atmosphere and outer space, it required the launching of the first Soviet Sputnik, in October of 1957, to direct the attention of the rest of the world to the challenge of space and to the consideration of what bearing that challenge might have on the affairs of men and nations.

The U. S. National Aeronautics and Space Administration was created in 1958, to press forward with a national aeronautics and space program. The former National Advisory Committee for Aeronautics was the nucleus for the new Administration. Its budget jumped to one-third of a billion dollars in fiscal

year 1959, to half a billion in 1960, to a billion dollars in 1961, reaching, during this present fiscal year, a one and three-quarter billion dollar level. The President's request to Congress for the next fiscal year approaches four billion dollars.

These are tremendous sums. It is absolutely essential, in allocating such enormous resources to any use, to weigh carefully the pros and cons. One naturally asks, and should ask, what do we get out of the program for our dollars? What will be the returns on our investment? Should these resources, perhaps, be applied in some other way? Why is the space program of importance?

Let us consider these questions, which are encompassed by the more general question: Why space?

First: <u>What Is the United States Space Program?</u>

This is necessarily the first question to consider. Before one can discuss the program intelligently, or criticize it, or attempt to evaluate it, one must know what the program is.

Basically, the space program is designed to use the rocket and related equipment and techniques to extend man's sphere of action, to advance his knowledge about the universe, and to advance technology and the applications thereof.

The scientific investigation and exploration of the earth's atmosphere and outer space, including the moon, planets, sun, and stars, comprises a very important part of the space program. Rockets, satellites, and deep space probes give man an extremely powerful tool for studying the universe in which he lives.

The search for life beyond the earth is one of the most exciting parts of the space program. What a tremendously exciting thing it would be to find life, either as we know it, or different from that we know, on one of the planets! In addition, space vehicles and space techniques are being used for studying the effect of strange environments and conditions on living matter. Such investigations

enable the bioscientist to probe into the question of the origin and nature of physical life.

To advance our technology, there is a wide variety of researches underway. Without attempting to list them all, here are some typical examples. There is research on materials; fuels; chemical, electric, and nuclear propulsion; solar, nuclear, and other varieties of power supplies; communications; guidance and control; computing techniques; measurement techniques; life support systems; etc. The program seeks to apply space knowledge and techniques to practical uses. Prime examples of how valuable such applications can be are furnished by the meteorological and communication satellites being developed under NASA's direction. The Department of Defense has a vigorous program of developing the military uses of space. One of these military developments, the navigational satellite, will also be developed under NASA auspices for civilian sea and air navigation.

We are developing rockets and space vehicles which are basic to our ability to press forward in the exploration and use of space. With the Centaur, we shall have an increased payload capability to use in exploring the moon and planets. The early version of the Saturn will put us into position to launch ten ton payloads into orbit about the earth and over two tons to the moon. More advanced versions of the Saturn, and the Nova rocket, with tremendously greater payload capabilities, will be required to land men on the moon and return them safely to earth.

Manned space flight is an important part of the national space program. Project Mercury is a first step toward manned flight to the moon and planets. Project Apollo is a second step, involving flights around the moon, and extended flights in near earth orbits. To land men on the moon and to bring them back to earth is an objective that President Kennedy has set forth

as a major milestone in the national space program. When we have reached this milestone, we shall be well on our way to putting man in a position to investigate and explore the moon and planets at first hand.

Finally, the national program includes a vigorous research effort in aeronautics. The United States has been a pioneer and leader in this field, and we intend to maintain our leadership.

Second: What Do We Get Out of the Space Program?

It is only natural, when presented with something that is going to cost hard-earned dollars, to ask: "What good is it?" In the case of the space program, the answer is multifold.

Out of the scientific research will come knowledge. Knowledge about the universe and its laws. Knowledge about the earth on which we live,

its atmosphere, the sun, and the sun's influence on our earth. Knowledge about physical life, its origins and fundamental nature.

It is such knowledge that puts mankind in a position to develop applications to human progress and welfare, to make new consumer goods, to build up our standard of living. We are doing this for ourselves right now with the legacy of knowledge given us by our forebears. Some of the knowledge that we are now gathering in such broad areas as space research, we will ourselves use for our own gain. But more than that, it will be our legacy to our children and grandchildren, for them to use in furthering their own welfare. If we fail to bequeath them such a legacy, we shall do them a great disservice indeed.

Past experience has shown that the most important benefits of our research are probably unforeseen. Yet there are many areas in which we can predict direct benefits. The results of

materials research -- ceramics, metals, plastics, for example -- will inevitably find their way into industry and to the consumer. The values of new fuels, new methods of power generation, and supersonic transportation are clear.

Satellite communications give us a way of relieving already overburdened communications channels, a way that is more than competitive economically with completely ground-based radio and cable. So promising is the satellite approach that the communications interests are ready to devote huge sums of private capital to developing the satellite possibilities.

The TIROS weather satellites have already shown vividly what can be done with satellites to aid in weather surveillance and forecasting. The improved Nimbus satellites to come will provide the basis of an operational weather satellite system. Just the dollar value of being forewarned about approaching hurricanes and typhoons, of

being able to schedule with certainty, as far as weather is concerned, industrial, commercial, agricultural, and mining operations, repays the outlay many times over. The importance of weather to military operations makes clear the military value of weather satellites.

From the space program will come navigational satellites, perhaps patterned after the Navy Transit Satellite, which can be used in all kinds of weather, day or night. The importance to peace-time shipping and to military navigation, is abundantly clear.

From the effort to place man in space will come a host of direct and indirect benefits. The study of man himself will advance the fields of medicine and psychology. Studies of human performance will show us how to use men more effectively in industry and elsewhere. The advance in technology brought about by the requirement to provide for man's needs when he is in outer space, either on the way to the moon or a planet, or on the moon

or planet, will contribute significantly to human welfare here on earth. For example, the development of special foods may be of assistance in tackling the food problem on earth, which is potentially one of the greatest problems facing mankind today, in view of the rapidly expanding population of our planet.

The tremendous upsurge in our technological capabilities will find its way into all fields of engineering -- construction; road building; power generation; chemical processing; development of natural resources; etc. Industry will feel its stimulus and commerce will benefit.

The conduct of the space program pours dollars into our economy, and stimulates activity and growth. If thoughtfully and properly carried out, the space program should provide a tremendous feedback not only into our economy, but also into our social and political growth.

The use of satellites for communications, weather observation, and surveillance contributes to our military strength.

Finally, the demand for technically trained people will stimulate and benefit higher education.

Third: Why Should the United States Support a Space Program?

The answer to this question is really embodied in the answer to the previous question. The abundant returns that are assured make the support of the space program a sound investment, an investment that will repay each dollar many times over.

The scientist participating in the program will urge support of the effort because it involves an attack on some of the most important and fundamental scientific problems of the day. A nation that wishes to remain strong and a leader in science must support a vigorous attack on such problems.

The engineer and technologist engaged in the program will point out that the effort involves an attack on the most difficult and challenging problems that man has ever undertaken to solve. Just as the student, during his days of schooling, progresses

by tackling and solving problems, so also does the professional man as he applies his learning and past experience to carving out new achievements and accomplishments. As a nation, we shall grow tremendously in our engineering and our technological capabilities as we apply ourselves to the solution of the problems involved in placing a man on the moon and exploring the solar system. We shall also inevitably reap the rewards of this growth.

The practical man will point to the great value of meteorological, communications, and navigational satellites as ample reason for supporting the space program. And, if he understands how the ability to develop such practical applications rests on the basic science and engineering research of the past, he will wholeheartedly support the scientific and engineering research of the present. He will observe, as history very clearly shows, that the byproducts of a scientific

and engineering program as broad and as extensive as our space program, are bound, in the course of time, to repay the initial investments many times over.

If his understanding goes even deeper, he will recognize that some of the most valuable payoffs may well be completely unforeseen, and yet are assured.

Fourth: <u>What Does Success or Failure in Space Activities Mean to the United States in International Matters?</u>

In the eyes of the world, space has become a symbol. Success in space research and exploration has come to mean ability and competence in science and engineering. Leadership in space has become synonymous with leadership in science and engineering.

We cannot afford to lose our leadership in these fields. On such leadership rests very important elements of our world commerce. World demand for our industrial and technical products stems from the evaluation of our products as "tops."

Certainly, we would not want to see the countries of the world turning to Russia for industrial and technical products that they once got from us, because, rightly or wrongly, they regard the U. S. as no longer the best place to get these things. We would not want to see the countries of the world, because they were so impressed by Russian space achievements, or so unimpressed by our effort, turning to Russia for technical education and training. If their young scientists and engineers sought entry into Russian universities instead of into American, we would lose our opportunity to sell the American way of life to these students, and you may be sure that the Soviets would make the most of the opportunity to sell their ideas.

Although one cannot claim that winning the space race will win the Cold War for us, nevertheless, I am convinced that losing it would be disastrous. Our prestige and political influence would decline and our commerce, industry, and standard of living would suffer.

Fifth: What Constitutes Winning the Space Race?

Being first in everything is not required. But a substantial show of significant firsts is necessary.

The open, civilian, peaceful character of our space program is proving to be a tremendous factor on our side in this race. We must continue to maintain this image, making the results of our scientific investigations available to the entire world. We must be wise in protecting this image before the world. Our detractors would have the world believe that because we have a program to develop military applications of space, that our space effort is non-peaceful. Nothing could be further from the truth. Even our military effort is non-agressive in character. It is directed toward our defense. We have a right to apply space knowledge and techniques to our defense. The existence of such a program does not detract one whit from the peaceful character of our space effort.

Our application of meteorological and communication satellites to the benefit of the entire world will go a long way toward winning the space race, and toward establishing clearly the peaceful benevolent character of our space program.

Sixth: Why Don't We Spend the Tremendous Sums Going into Space Activities on Important Problems Closer to Home?

This is a commonly recurring question. The complaint is often voiced that the money going into space should be directed instead into tackling the food problem, or medical research, or education at home and abroad, or foreign aid, or strengthening our military position.

Actually the space program itself contributes in no small measure to all of these things. We have already pointed out how space research stimulates and will promote the growth of all fields of science and engineering, and how the effort to place man in space will promote medical research and will contribute

to solving the food problem. The demand for scientists and engineers will stimulate progress in education. International cooperation in the conduct of the space program will provide effective foreign aid in assisting countries to develop their own talents and resources. And we have already pointed out how important space is from a military point of view.

Furthermore, it is not at all clear that additional monies would be available to other areas of activity were the space program to be dropped or curtailed. The Congress has already appropriated to the other activities the sums considered necessary for them. The judgments on which these allocations of funds were made would very likely be little affected by a decision to cut back on space.

Seventh: Why Should We Waste Our Natural Resources by Shooting Them to the Moon?

We do not plan to shoot our natural resources to the moon. The total amount of material and

equipment that goes off into space on a Saturn space firing, for example, amounts to several automobiles. In contrast, most of our space program stays right here on earth: the thousands of new jobs that are created; the new knowledge that is obtained; the advances in technology; the new applications that stem from the new knowledge and technology; new products and processes; the industrial plant and all the other facilities created in support of the program; and the dollars allocated to it. They all stay here and contribute to our progress and advancement.

Eighth: How Do We Undertake to Accomplish the Space Program?

I do not really intend to discuss this question in its entirety, since that would fill a complete talk in itself. Instead, I wish to direct attention to what may well be the most important aspect of this problem -- manpower.

The success of the space program rests directly on the shoulders of the highly trained and skilled men who undertake the effort. In this regard, our educational institutions bear a great responsibility in the space program, for which the required training in many cases reaches not only to the Ph.D level, but well beyond.

Our universities and colleges are called upon to produce the required trained manpower. Some of this manpower will go into NASA and the other government agencies participating in the space program, some will go into industry, some into private research organizations. But some will, and must, remain in the universities where they not only continue to do research, but also to produce new talent. This is a most important function. The government laboratory, industry, the research foundation, all use up trained talent without reproducing this vital resource. The university alone replenishes the resource by the production of new engineers and scientists.

NASA wishes to work with the educational institutions in this country to strengthen our national space effort. The single greatest body of scientific research talent in the country resides in the university community. It is hoped that many of these scientists will be attracted by the challenge of space and will join the research effort.

NASA proposes to work with the universities in such a way as to help strengthen the university, while at the same time securing assistance in the space program. For this reason, NASA proposes to work within the existing university structure, and not to set up activities that tend to draw the strength away from the university, and to draw the university researcher away from his teaching. We can help support research in the university. We can help in the production of necessary trained talent for the space program by providing training grants. To a limited extent, we can assist in the provision of buildings and facilities.

I think that it is clear that NASA cannot undertake to meet all the needs of the universities, or to run a program of general support to education. NASA has neither the resources, the responsibility, nor the prerogative to do this. Whatever NASA does in this area must be related to the space mission. However, accomplishing the space mission absolutely requires the strong and vigorous participation of our universities and colleges, which in turn, requires that NASA bear its fair share of the support required to make it possible for the universities and colleges to participate. The universities must bear their share of responsibility to the space program and allocate an appropriate fraction of their material, as well as human, resources to the effort. In such a partnership, NASA stands ready to invest an appreciable fraction of its resources.

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In summary:

-- The space program is a broad program of science, exploration, technological developments, and applications to human welfare.

-- The program will yield full returns on every dollar expended, in the form of knowledge; advanced technology; applications to human welfare, meteorology, communications, and navigation; contributions to our military strength; benefits to education, industry, commerce, and agriculture; stimulation of our economy; development of profitable international ties through mutual cooperation in space activities.

-- Success and leadership in the space program is an essential ingredient to our winning the Cold War.

-- The space activity benefits a broad range of other activities, by providing money and support that would probably not otherwise be provided.

-- Virtually all the monies and resources that we expend on the space program remain at home on earth in the form of benefits to our country and to mankind.

In the light of the foregoing, the project to send men to the moon takes on a proper perspective.

It is neither useless nor foolish. It becomes a symbol of our determination to keep our science and technology alive and growing. It is a symbol of our determination to maintain our role of leadership in the world, and to realize to the fullest the capabilities of a democracy. We <u>will</u> accept the great challenges that come to face us; we <u>will not</u> turn away from them and so consent to becoming a second-rate nation.